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Notes on the comparative Resistance to high Temperatures of the Spores and Mycelium of certain Fungi

BY ABIGAIL A. O'BRIEN

It is a well-known fact that the spores of bacteria are more resistant to heat than are the vegetative cells. It has been generally believed that the same is true of fungi, that is, that the spore is better able to resist a high temperature than is the mycelium. The method of fractional sterilization has in fact been based upon that belief. Professor B. M. Duggar suggested to me that in the case of some fungi, especially those with thin-walled spores, the mycelium might be at least as resistant to moist heat as are the spores. His work on *Sporotrichum globuliferum** indicated that with this fungus such is the case. The following series of experiments on five representative fungi, carried on under his directions, confirms his results in general.

Methods.—The fungi experimented upon were *Aspergillus flavus*, *Botrytis vulgaris*, *Rhizopus nigricans*, *Sterigmatocystis nigra* and *Penicillium glaucum*. They were grown upon beet cylinders in test-tubes. The mycelium used in these experiments was taken from the culture tubes within two and one half days after the fungus had begun to grow and before any spores had formed. The spores used in the experiments were from one to two weeks old. The spores were placed in sterilized test-tubes filled to the height of about one inch with beet decoction. The tubes were then put in a boiler heated to the desired temperature and left for five, ten, fifteen, thirty or sixty minutes. After the exposures, drop cultures of the decoction in the tubes were made in Van Tieghem cells. The spores of *Aspergillus* and *Sterigmatocystis* showed a tendency to float on the surface of the liquid and to collect in small masses. It was therefore found necessary to immerse them in distilled water before putting them in the decoction. In the experiments with the mycelium, a bit of the hyphal mass was removed from the plug with a sterilized needle, and was then treated exactly as the spores were. The cultures were in all cases

* Bot. Gazette, 31 : 38-66. Ja. 1901.

accompanied by checks, which gave uniform growth and are therefore not recorded. The cultures were usually examined twenty-four hours after they were made, and again within two or three days. Results were recorded after the first examination, but additions were sometimes made upon later examination.

The figures in the table indicate the percentage of growth. In the case of the mycelium it was found impossible to indicate the new growth by exact per cents., hence fresh growth is indicated in all cases by (g) which is recorded only where vigorous fresh growth appeared on all sides of the bit of mycelium.

No.	Tempera- ture °C.	Fungus	Spores					Mycelium				
			Time of Exposure in Minutes					Time of Exposure in Minutes				
			5	10	15	30	60	5	10	15	30	60
Percentage of Germination Growth												
1	45	Botrytis.	all	90	40	50	2					
2		Rhizopus.	all	20	30	40	5					
3		Aspergillus.	98	98	98	98	80					
4	47	Botrytis.	50-75		5-15	10	0					
5		Rhizopus.	50-75	25	10	20	10					
6		Sterigmatocystis.				75	100					
7	50	Aspergillus.	90	40	10	0	0				g	g
8		Botrytis.	65	2	1 or 2 spores	1 or 2 spores	2				o	o
9		Rhizopus.	1 or 2 spores	45	15	0	0				g	g
10	52	Sterigmatocystis.	98	90	40	0	4				g	g
11		Aspergillus.	90	80	35			g	g	g		
12		Botrytis.	20	10	1			g	g	g		
13	53	Rhizopus.	1-2	2-3	0			g	g	g		
14		Sterigmatocystis.	all	90	80	0		g	g	g		
15		Aspergillus.						g	g	g		
16	55	Botrytis.						g	g	g		
17		Aspergillus.	0	0	0	0	0	o	o	o		
18		Botrytis.						o	o	o		
19	60	Rhizopus.						o	o	o		
20		Sterigmatocystis.	2	1	0	0	0	g	o	o		
21		Penicillium.	50	20-50	10-15	5	5	g	g	g	g	o
22	65	Penicillium.	0	0	0	0		g	g	g	g	g

Certain experiments were omitted, hence blank spaces appear in the table. For instance it was found that the mycelium of all the fungi except *Botrytis* gave vigorous fresh growth at 50° for the two longer exposures, 30 and 60 minutes, hence it is unnecessary to try it at lower temperatures. Also *Penicillium*, both spores and mycelium, gave vigorous growth at 55°, and was, therefore, omitted from the experiments at lower temperatures.

It will be noticed that the percentage of spores germinated does not always vary inversely as the length of the time of exposure, as would be expected. This discrepancy, however, can only be accounted for by the variation in resistance of individual spores.

The results given in the table, especially those of experiments 7, 9, 10, 12, 13, 22, seem to warrant the conclusion that in the five fungi studied, the spore, that is, the conidium, is no more resistant to moist heat than is the mycelium.

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